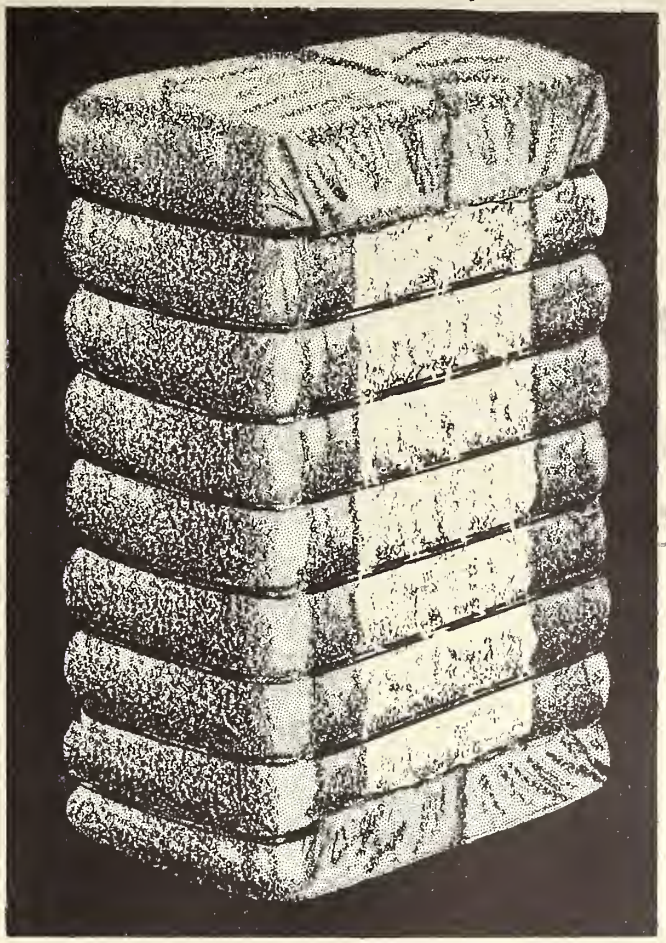
COTTON LINTERS

PRODUCTION, MARKETING, and MARKET OUTLETS



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CONTENTS

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SUMMARY

This study was conducted with a view to appraising the effect of changes in varieties of cotton planted and harvesting, ginning, and milling practices on the production, marketing, and market outlets for cotton linters. Information was obtained by the survey method from representative oil mill operators, linters dealers, brokers, and converters throughout the United States during the 1951-52 season, and from secondary sources.

Annual production of linters ranged from about 741,000 bales in 1932-33 to 1,747,000 bales in 1951-52, depending primarily upon the volume of cottonseed produced. Domestic production of linters is augmented by carryover of linters from previous seasons and by imports, although imports are more than offset by exports in most seasons. Domestic consumption approximates U. S. production of linters. Usually about one-third of the linters produced are felting grades and two-thirds are chemical grades. Production of chemical grades increased as total production increased, whereas felting grades showed only slight increase.

A majority of the oil mill operators gave primary consideration to demand and relative prices of various qualities of linters in deciding on the quantity and quality of linters to remove from cottonseed. Also considered important were the differences in linters content of various lots of cottonseed and in type of mill processing equipment. More than nine-tenths of the linters produced in 1951-52 were collected by the flue system, and differed substantially in appearance and foreign matter content from linters collected by the condenser system.

Marketing of cotton linters is a relatively simple and direct process. In 1951-52, chemical-type linters were usually sold by oil mills direct to converters. By comparison, felting-type linters were most frequently marketed through brokers and dealers. Quality evaluations were customarily made during production at oil mills in an attempt to maintain uniform quality, and to produce qualities offering the most advantageous prices and market outlets. In the marketing of felting-grade linters, evaluation of quality was frequently based on the buyer's and seller's own conception of quality, whereas for chemical-grade linters quality evaluation consisted of inspection for foreign matter, final settlement being based on cellulose content.

Although oil mills ordinarily do not store linters for extended periods, they could have provided covered storage facilities for 22 percent of the linters produced in 1951-52. Dealers customarily do not store linters between purchase and sale, whereas converters, particularly bleachers, usually carry a reserve supply.

Market outlets for linters include a wide variety of chemical, felting, and other products. Chemical uses represent about 60 percent of total consumption. Chemical-grade linters, after being processed into linters pulp, compete directly with higher qualities of wood pulp. Production of wood pulp has steadily increased and qualities improved to such an extent that wood pulp could now almost completely replace linters.

Cellulose pulp requirements of the high-tenacity rayon and acetate industries were equivalent to more than 1,000,000 bales of linters in recent years. However, in 1952 linters pulp comprised only 12 percent of total pulp consumed in rayon. The higher and more unstable price of linters pulp was a distinct competitive disadvantage, although linters pulp contains a higher percentage of pure dry alpha cellulose than does wood pulp as marketed. Linters will not compete effectively with wood pulp unless price is maintained at a competitive level.

Paper of the rag-content type offers considerable promise as a potential market outlet for about 300,000 bales of linters per year. Cotton rags, customarily used as the source of cellulose in making fine paper, now frequently contain blends of synthetics or new dyes which present technological problems in processing. The price factor has been an obstacle to more extensive use of linters in fine paper.

Consumption of linters for felting purposes amounted to about one-half million bales per year recently and was about equal to the volume of felting grades produced. In 1951-52, linters comprised between 50 percent and 60 percent of the fibrous material used in bedding, automobiles, and furniture--the principal nonchemical uses for linters. The proportion of linters used by felting manufacturers was primarily dependent on relative prices of linters and competing materials. Foam rubber has increased in popularity in recent years but has not constituted a serious threat to linters on the basis of volume consumed or price. It appears that consumption of linters by the felting industry will be maintained at about the present rate so long as supplies are adequate and prices remain about equal to or lower than certain grades of cotton waste.

More than 22,000 bales of linters were used in the manufacture of battery boxes and absorbent cotton in 1951-52. The higher qualities of second cut linters are preferred for these uses.

COTTON LINTERS—

PRODUCTION, MARKETING, AND MARKET OUTLETS

By Marion E. Whitten, cotton technologist, and Joseph H. Stevenson, agricultural economist, Cotton Branch, Production and Marketing Administration

INTRODUCTION

Cotton linters are the short fibers, or fuzz, remaining on cottonseed after the lint cotton has been removed. Annual production of linters in the United States in recent years has been approximately 1-1/2 million bales valued at about 50 million dollars. Linters represented, in the last 10 years, from 8 to 25 percent of the total value of products obtained from cottonseed, the percentage depending on relative prices of the oil, meal, linters, and hulls.

At one time linters were considered a nuisance, since they interfered with efficient milling of cottonseed. However, rapid improvements were made in the delinting process after the first delinter machine was patented in 1869. Probably the most significant change in the production process was the conversion from the condenser to the pneumatic system of collecting linters, although the condenser system is still used at some oil mills. Over a period of years notable changes occurred in the varieties of cotton produced and the linters content of cottonseed, in the pounds of linters cut from each ton of seed, and in methods of producing, harvesting, and ginning cotton. All of these affected the quantity, quality, and appearance of linters produced.

With the development of the delinter machine and the general delinting process, uses for linters also increased. Early commercial uses for linters included padding, stuffing and twines. Consumption increased greatly with the expansion of the nitrocellulose industry after the turn of the century. All linters were diverted to nitrocellulose production in World War I, and since that time uses of cellulose in rayon, plastics, and similar products have increased the demand for linters. In addition, large quantities of linters are now consumed in bedding, furniture, automobiles, battery boxes, and other products. However, linters compete with other materials in each of the principal fields of utilization, and have a distinct competitive disadvantage due to their relative instability in price and available supply. An evaluation of the competitive outlook for linters is desirable in view of the prospective decrease in market outlets due to competition from wood pulp, foam rubber, and other materials, as well as possible increases in the use of linters in such products as paper.

OBJECTIVES OF STUDY

The principal objectives of this study were: (1) To appraise factors affecting quantities and qualities of linters produced; (2) to provide information as a basis for considering possibilities of improving marketing practices; and (3) to evaluate market outlets for linters and competing materials with a view to determining the competitive outlook for linters.

METHOD AND SCOPE OF STUDY

Information relative to production, quality standards, marketing practices, and conversion of cotton linters was obtained by personal interview during the 1951-52 season from representative cottonseed oil mill operators, linters dealers and brokers, and converters of linters throughout the United States.

The oil mill operators, dealers and brokers, and converters who furnished information were distributed geographically, as well as by size and type of operation, to provide adequate representation of each segment of the linters trade. For purpose of analysis, the United States was divided into six geographic regions as follows: Northeastern, northcentral, southeastern, southcentral, southwestern, and far western.

SUPPLY AND DISTRIBUTION OF LINTERS

Annual production of linters varies directly with the production of cottonseed and with the proportion of the seed crop processed by the cottonseed oil milling industry. On the average, approximately 180 pounds of linters are obtained from each ton of cottonseed. During the last two decades, annual production ranged from 741,000 bales of about 600 pounds each in 1932-33 to 1,747,000 bales in 1951-52 (table 1). The domestic supply is augmented to a limited extent by imports, particularly from South American countries. Usually, however, exports of linters somewhat exceed imports. Normally, about one-fourth of the total domestic supply is represented by the carry-over from the previous seasons (fig. 1).

During the last two decades, domestic consumption ranged from a low of 641,000 bales in 1931-32 to a high of 1,617,000 bales in 1949-50 (fig. 2). Usually domestic consumption approximates United States production of linters.

Table 1.--Supply and distribution of cotton linters in the United States, seasons 1930-31 through 1951-52 1/

Season	Supply				Distribution		
	Stocks at beginning of season	Production 2/	Imports	Total supply	Domestic consumption 3/	Exports	Carryover at end of season 4/
	1,000 bales	1,000 bales	1,000 bales	1,000 bales	1,000 bales	1,000 bales	1,000 bales
1930-31	486	824	-	1310	724	112	503
1931-32	503	876	-	1379	641	116	625
1932-33	625	741	-	1366	766	184	444
1933-34	444	801	-	1245	777	169	344
1934-35	344	805	7	1156	720	205	295
1935-36	295	876	45	1216	735	241	267
1936-37	267	1127	47	1441	820	270	363
1937-38	363	1470	18	1851	719	275	865
1938-39	865	1113	49	2027	867	213	950
1939-40	950	1072	63	2085	1065	320	706
1940-41	706	1208	252	2166	1360	21	787
1941-42	787	1183	194	2164	1491	33	637
1942-43	637	1354	79	2070	1303	28	739
1943-44	739	1180	74	1993	1368	61	567
1944-45	567	1247	199	2013	1483	41	379
1945-46	379	989	215	1583	1055	22	422
1946-47	422	992	92	1506	984	53	357
1947-48	357	1282	127	1766	1156	235	370
1948-49	370	1639	115	2124	1407	193	495
1949-50	495	1693	200	2388	1617	189	452
1950-51	452	1226	103	1781	1396	92	264
1951-52	264	1747	113	2124	1308	226	548

1/ Running bales, except that imports are equivalent 500-pound bales.
2/ Excludes small quantities produced at gins and other delinting plants.
3/ Includes small quantities reported as destroyed.
4/ The differences between reported supply and distribution may be caused by inclusion of some motes, sweepings, etc. in consumption or to inclusion of motes, grabbots, etc. in production figures.

Source: Bureau of the Census.

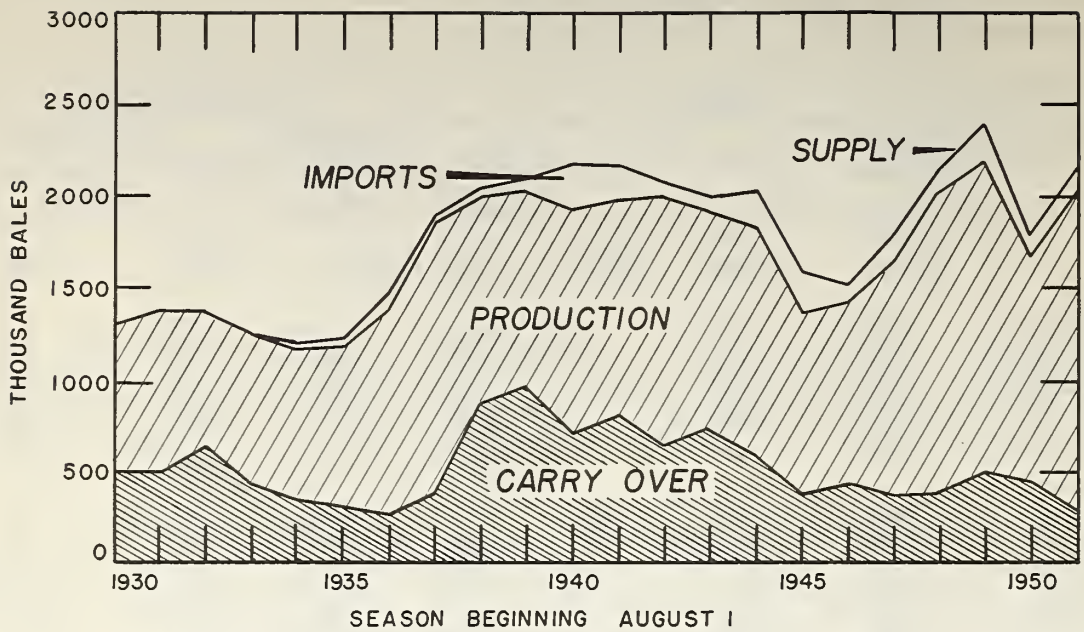

Figure 1.--Supply of cotton linters in the United States, seasons 1930-31 through 1951-52.

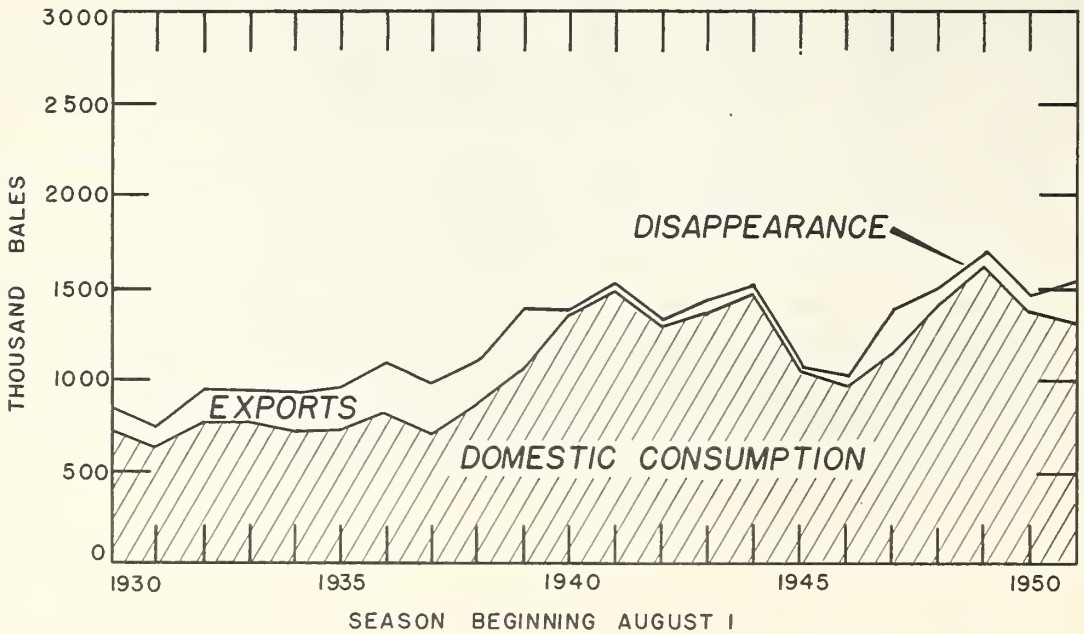

Figure 2.--Disappearance of cotton linters in the United States, seasons 1930-31 through 1951-52.

QUALITIES OF LINTERS PRODUCED

The seven U. S. standard grades of linters may be divided into two major categories in accordance with the principal fields of uses. Grades 1 through 4, are referred to as the "felting grades," whereas grades 5 through 7 are termed the "chemical grades," since linters of those grades are used almost exclusively by the chemical industries. The felting grades are normally obtained from the "first cut" process which removes the longer fibers from the cottonseed. The chemical grades, consisting of the shorter fibers, are obtained from the "second cut" process. In some instances the linters are removed from the seed in one process, in which case, the product is termed "mill run" linters. Such linters usually are classified as U. S. standard Grades 3 and 4.

When the fiber is removed from the seed the proportion removed as first cut and second cut, and mill run are subject to considerable adjustment. The market situation for the respective qualities determines to a large extent the relative proportion removed in each process.

The qualities falling into each of the U. S. standard grades and groups of grades varied considerably during the period 1933-34 to 1951-52 (table 2). Usually about one-third of the bales produced are of the felting grades and two-thirds are of the chemical grades. For the season 1936-37, however, almost one-half of total production was of the felting grades. It will be observed that Grade 6 was by far the most important from the standpoint of bales produced. Only limited quantities were classified as Grade 1. Production of the chemical grades increased somewhat more than proportionately as total production increased, whereas production of the felting grades did not show any marked tendency to increase (fig. 3).

FACTORS AFFECTING LINTERS PRODUCTION

Content and Yield of Linters from Cottonseed

The quantity of linters which can be removed from cottonseed is dependent, primarily, upon the amount of linters on the seed. Linters content of different lots of cottonseed varied from 3 to 20 percent, representing a difference of 340 pounds of linters per ton of cottonseed. These variations were attributed principally to differences in varieties of cotton and environmental conditions during growth. Although extreme variations are rare, variations of from 2 to 3 percent in linters content of different bale-lots of cottonseed are not uncommon in contiguous areas growing a single variety of cottonseed. In areas producing more than one variety, greater differences occur in linters content.

Table 2.--Qualities of linters produced in the United States, seasons 1933-34 through 1951-52 1/

Season	Felting grades					Chemical grades				Total all grades
	Grade 1	Grade 2	Grade 3	Grade 4	Total	Grade 5	Grade 6	Grade 7	Total	
	1,000 bales	1,000 bales	1,000 bales	1,000 bales	1,000 bales	1,000 bales	1,000 bales	1,000 bales	1,000 bales	1,000 bales
1933-34	20	169	90	90	369	174	250	8	432	801
1934-35	16	114	130	96	356	143	273	33	449	805
1935-36	15	109	144	109	377	155	312	32	499	876
1936-37	37	159	157	182	535	197	365	30	592	1,127
1937-38	26	197	231	188	642	263	528	37	828	1,470
1938-39	30	136	143	112	421	177	465	50	692	1,113
1939-40	33	174	104	87	398	167	456	51	674	1,072
1940-41	28	142	184	114	468	246	459	35	740	1,208
1941-42	59	119	59	47	284	130	662	107	899	1,183
1942-43	5	10	11	104	130	547	604	73	1,224	1,354
1943-44	4	75	170	64	313	191	643	33	867	1,180
1944-45	16	112	107	60	295	325	588	39	952	1,247
1945-46	17	101	129	111	358	187	358	86	631	989
1946-47	16	105	175	157	453	91	405	43	539	992
1947-48	34	163	141	57	395	78	311	498	887	1,282
1948-49	37	154	152	115	458	338	515	328	1,181	1,639
1949-50	36	158	220	175	589	440	487	187	1,114	1,703
1950-51	17	124	146	120	407	301	321	197	819	1,226
1951-52 2/	20	185	205	223	633	470	496	148	1,114	1,747

1/ Excludes small quantities produced at gins and other delinting plants.
2/ Preliminary

Source: Weekly Cotton Linters Review, Cotton Branch, PMA.

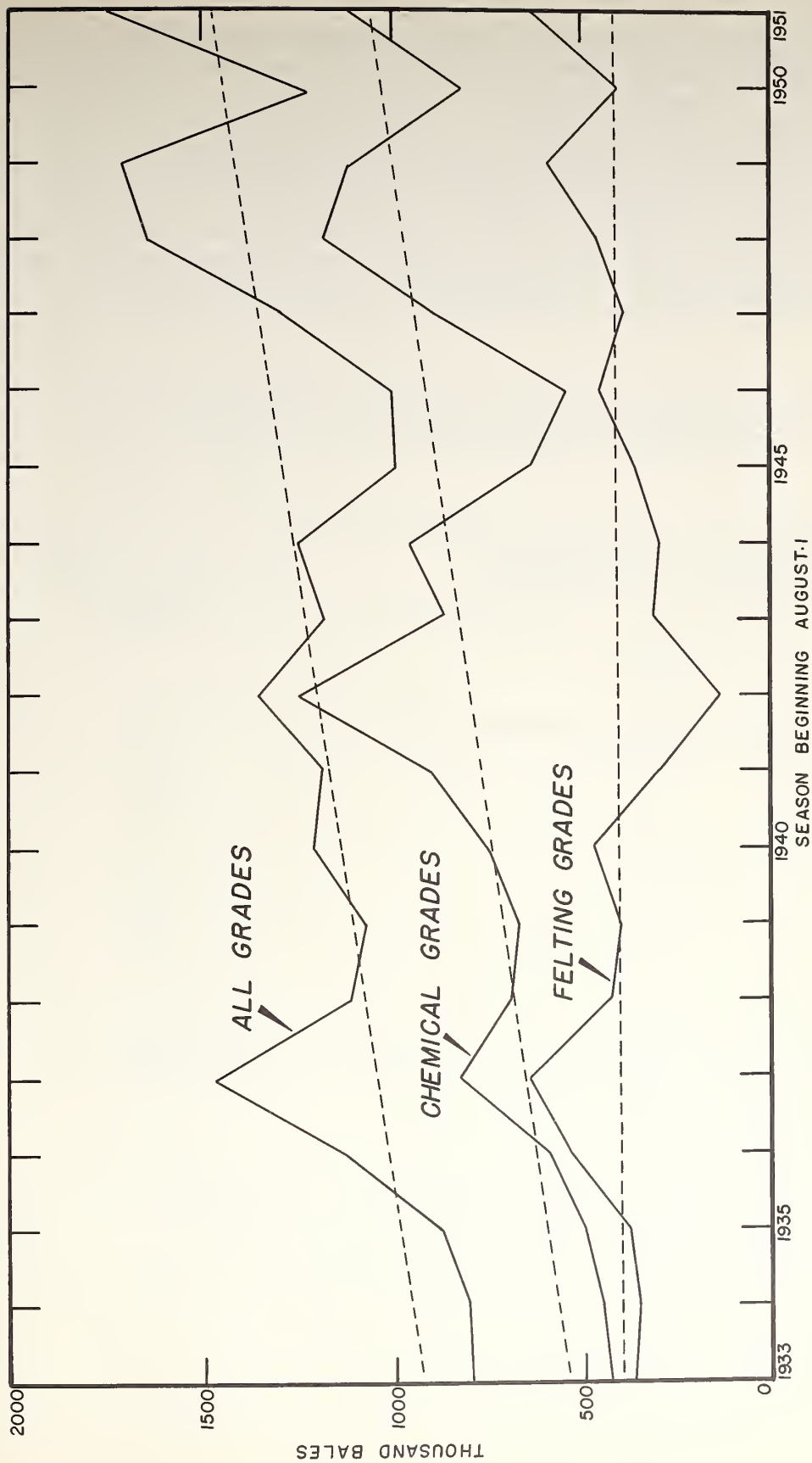

Figure 3. -- Cotton linters production in the United States, by type, seasons 1933-34 through 1951-52.

281101 O - 53 - 2

Approximately 75 percent of the oil mill operators made some attempt to determine linters content of cottonseed to be processed in the 1951-52 season (table 3). Chemical analyses were employed in determining linters content by 33 percent of the oil mill operators. Most of such analyses were obtained separately from regular cottonseed analyses. However, obtaining linters analyses along with usual seed analyses at periodic intervals was not uncommon, particularly by larger oil mills. Linters content was usually included as a part of official cottonseed grade analyses in some areas of Texas and Oklahoma. Linters content of seed was estimated by visual inspection by 44 percent of the oil mill operators.

Table 3.--Proportion of oil mill operators using specified methods in determining linters content of cottonseed, United States, season 1951-52

Method of determining linters content of cottonseed	Proportion of oil mill operators
	Percent
By chemical analysis--	
As part of official cottonseed analysis...	6
As a separate analysis	27
Estimated	44
No determinations made	23
Total	100

Some oil mill operators expressed the opinion that accurate analyses for lint content were not necessary. They assumed that cottonseed was uniform in linters content, especially in areas producing a single variety of cotton.

During a recent 20-year period, the average yield of linters per ton of cottonseed ranged from 93 pounds in 1932-33 to 191 pounds in 1946-47 (table 4). A rather steady increase occurred in the quantity of linters removed from seed from the early 1930's until World War II when maximum production was emphasized for war needs. Since

that time, oil mills have apparently found it most practical to remove an average of about 180 pounds of linters from each ton of seed processed.

Variations in yield of linters at oil mills in different sections of the Cotton Belt are significant. During the 5-year period 1942-46, average yield of linters varied from 158 pounds per ton in Alabama to 198 pounds per ton in Oklahoma. Yearly production during this period ranged from 131 to 172 pounds per ton in Alabama, and from 181 to 227 pounds per ton in Oklahoma 1/. Here again such variations are due principally to differences in linters content of cottonseed.

Table 4.--Average yields of linters per ton of cottonseed processed at oil mills in the United States, by seasons 1932-33 through 1952-53

Season	Average yield of linters per ton of cottonseed processed
	Pounds
1932-33	93
1933-34	112
1934-35	135
1935-36	137
1936-37	150
1937-38	138
1938-39	148
1939-40	154
1940-41	165
1941-42	180
1942-43	184
1943-44	179
1944-45	176
1945-46	182
1946-47	191
1947-48	186
1948-49	183
1949-50	176
1950-51	185
1951-52	185
1952-53	1/ 184

1/ Preliminary
Source: Bureau of the Census

1/ Whitten, Marion E., The Grading of Cottonseed, AIB 39, U. S. Department of Agriculture, May 1951.

Factors Considered by Oil Mill Operators

The amount of linters to be removed from cottonseed is directly related to efficient milling as well as to linters content of the seed. Oil recovery is reduced if sufficient linters are not first removed from the cottonseed in the milling process. Oil mills usually reduce the linters on cottonseed to about 3 percent in order to facilitate efficient recovery of oil.

Demand and relative prices for particular qualities were of primary importance to 63 percent of the oil mill operators in deciding upon the quantity and quality of linters to remove from cottonseed (table 5). If the prices of particular grades were relatively high and the demand outlook favorable, production of those qualities was increased. The linters content of the cottonseed being processed was a primary factor governing the amount and type of linters removed from the seed, according to 24 percent of the oil mill operators. About 8 percent of the oil mill operators were primarily interested in maintaining maximum quality and at the same time recovering the largest practical quantity.

Table 5.--Primary considerations of oil mill operators in determining the quantity and quality of linters to be produced from cottonseed, United States, season 1951-52

Primary consideration given to--	Proportion of oil mill operators
	Percent
Demand for particular qualities	63
Linters content of cottonseed	24
Maintaining quality with maximum quantity	8
Other considerations	5
Total	100

Oil Mill Processing Facilities

The removal of linters from cottonseed is one of the most expensive operations performed by the crushing mill. 2/ The requirements in labor, power, floor space, and equipment for the delinting operation are relatively large considering the economy of the entire milling process. To obtain efficient delinting and desired quantities and qualities of linters, the oil mill operator must consider carefully the number, type, and method of operating the delinting machines as well as the method of collecting and cleaning the linters. Since the delinting machine itself is similiar in construction and operation to a saw gin for cotton, there is a variation in the amount and quality of linters removed, depending upon the sharpness, speed, and size of the saws, the density of the seed roll, and the length of time the seed are subjected to the action of the saws.

After the linters are removed from cottonseed by the delinting machines, they are collected by either the individual delinting machine condenser system or a pneumatic system. Until the introduction of the pneumatic system, mills used the condenser system in which linters are blown from the delinting machine to a slowly revolving screen where they are rolled into batts then conveyed by hand to the baling press. However, transition to the flue system of lint collection was rapid in recent years and in 1951-52 an estimated 92 percent of the linters were conveyed by the lint flue system to the baling equipment (table 6). There is a substantial difference in the foreign matter content as well as in the appearance of linters collected by the flue system (using beaters) as compared with the condenser system.

Table 6.--Proportions of cotton linters collected by specified methods at cottonseed oil mills in the United States, season 1951-52

Method of collection	Proportion of linters produced
	Percent
Lint flue method	92
Condenser method	8
Total	100

2/ Moloney, John F., Economics of Cottonseed Crushing. In Cottonseed and Cottonseed Products, Bailey, A. E., Interscience Publishers.

MARKETING OF COTTON LINTERS

Organization of Markets

The marketing of cotton linters is a relatively simple and direct process, and as is the case with other cottonseed products, it is somewhat seasonal in nature. Monthly shipments from oil mills follow monthly production rather closely since most oil mills have only limited facilities for storing linters, and costs, as well as risks, frequently outweigh advantages of storing this relatively bulky product.

Oil mills usually sell linters direct to converters who utilize them in the manufacture of end-products or sell to dealers who, in turn, resell to converters. Services of linters brokers may also be utilized in the marketing process. The function of the linters dealer is much the same as that of the cotton merchant in that the dealer assembles various qualities of linters and offers these for resale in lots of uniform quality.. The linters dealer also performs a financing function since he actually buys and resells, and may carry some linters on his account.

The linters broker, as the term implies, does not purchase and resell as does the dealer, but performs a marketing service by arranging for sales and purchases of linters. The broker customarily serves as bargaining agent for oil mills, and makes known the quantity, quality, and price of linters available. Brokers usually draw a nominal fee per bale for trades closed through them; however, according to customary trading rules, brokerage fees are not considered as earned if the linters are rejected and delivery is not effected.

Oil mills that carry out the first phase in marketing of linters are located throughout the Cotton Belt in relatively close proximity to the source of supply of cottonseed. A majority of the linters brokers and dealers have headquarters in centrally located cities in the producing belt. The larger "central markets" for linters include such cities as Memphis, Dallas, Atlanta, and Los Angeles. Dealers located outside the Cotton Belt usually have representatives in the producing areas. Firms purchasing linters for conversion into felting-type products are located throughout the United States, and converters of chemical-type linters have plants in the southeast and south central regions.

Marketing Channels

Approximately two-thirds of all chemical-type linters were sold by oil mills direct to converters during the 1951-52 season (table 7). By comparison, slightly more than three-fourths of the felting-type linters were sold through an intermediary marketing agency. Domestic converters of chemical linters usually obtained linters direct from oil mills. Some chemical grade linters were marketed through dealers and brokers, particularly in the case of exports. The typical converter of felting-type linters consumed a much smaller volume of linters than the chemical converter and found it more practical to purchase linters from dealers than from oil mills. However, nearly one-fourth of the felting-type linters were purchased by converters direct from oil mills. Some of these converters were located close to oil mills; others made arrangements direct with mills that produced the quality of linters particularly suited to their needs.

Table 7.--Proportions of linters marketed according to designated methods in the United States, season 1951-52

Marketing channel	Felting-type linters	Chemical-type linters
	Percent	Percent
Oil mill direct to converter	23	67
Oil mill to dealer to converter	65	24
Oil mill through broker to dealer to converter 1/	12	9
All methods	100	100

1/ Includes sales by oil mills through brokers to converters.

More than three-fourths of the felting and chemical-type linters purchased by dealers during 1951-52 were obtained direct from oil mills (table 8). Dealers utilized the services of brokers in obtaining approximately one-fifth of the volume of linters which they handled, whereas purchases from other dealers accounted for 5 percent or less of the linters handled by that group. Several dealers indicated that they did not handle chemical-type linters in 1951-52. Brokers reported that oil mills served as the principal source of linters which they handled.

Table 8.--Sources from which dealers obtained linters, United States, season 1951-52

Source	Felting-type linters	Chemical-type linters
	Percent	Percent
Oil mills	76	79
Brokers	19	19
Other dealers	5	2
All sources	100	100

Because of the actively competitive situation that usually exists in the linters market, prospective purchasers generally contact oil mills with regard to linters available for sale. Contacts by telephone are not uncommon; however, personal visits are often preferred so that an actual inspection can be made to determine the qualities of linters being offered. A sales agreement is sometimes made by telephone or by standing arrangement between mill and purchaser when the quality of linters produced by a mill is known by the purchaser.

Quality Evaluation

Methods of Evaluating Quality

Early attempts at classifying linters according to quality were made by some of the larger groups of cottonseed oil mills. These mills developed their own private types representing qualities that they usually produced. Private types of one organization did not necessarily correspond to those of another organization and such types varied from time to time. However, private types are still used as a method of evaluating quality, and are generally familiar to the linters trade.

The official standards for American cotton linters were established by the U. S. Department of Agriculture in August 1926. Development of standard grades was begun at the termination of World War I for use in disposing of the large amount of linters accumulated during the war. As production and demand for linters continued to increase, the need for uniform standards became increasingly apparent. In 1924, the U. S. Department of Agriculture, with the assistance of representative crushers, dealers, and converters, began a study of existing private types and

other means of evaluating quality. The present standards are a direct result of this work.

Due to the many changes that have occurred since the official linters standards were developed in 1926, an evaluation of the standards is now being made in order to ascertain the extent to which the standards represent current linters production and meet the needs of marketing agencies and converters as a basis for selecting linters having the quality characteristics required for specific uses. The technical basis for specific structural details will be established by use of scientific instruments as an accurate and precise guide in developing standards that will meet current needs as indicated by the linters trade. Measurement of ranges in quality items, such as color, staple, resiliency, and foreign material, are being studied. Findings will be released when the study has been completed.

As in the case of many agricultural commodities, linters are often purchased and sold according to the buyer's and seller's own conception of quality. The accuracy or thoroughness of such classification is problematical, as accuracy in appraising quality requires frequent reference to some authentic guide such as the official standards or private types. It is a common practice for buyer and seller to think of and discuss qualities in terms of the official linters standards, although bargaining and final settlement may be on the basis of actual inspection of lots offered. The practice of trading on description of qualities, without inspection, is not generally followed.

Control of Quality in Production

In order to maintain consistency of quality in production or to produce qualities that offer most advantageous prices or market outlets, some system of control or check on quality is generally used by oil mills in producing linters. In the 1951-52 season, quality control was used on 70 percent of the linters produced (table 9). At mills where no types or standards were used to control quality in production, it was a rather common practice to make frequent visual inspections as a check on the qualities being produced.

The official standards were used as a guide in controlling the quality of 43 percent of the linters produced during 1951-52. This method of control included the checking of qualities produced, by a licensed classifier or by an unlicensed classifier using a set of standards at the mill or group-mill headquarters. Private linters types were used in controlling the quality of 18 percent of the linters in production. The more widely known private types are similar to the official standards in many respects.

281101 O—53——3

Table 9.--Proportions of linters produced according to designated methods of quality control at oil mills in the United States, season 1951-52

Method of quality control	Proportion of linters produced in the United States
	Percent
Official standards	43
Private types	18
Cellulose determination 1/	9
No quality control used	30
Total	100

1/ This method was used on linters sold for chemical uses, and usually included visual inspection to determine type and amount of foreign matter.

The quality of second-cut linters sold as chemical linters is usually based on the cellulose content as determined by chemical analysis and on a visual inspection to determine type and amount of foreign matter. This method of quality control was used for 9 percent of total linters production. It does not include cellulose analyses used in marketing transactions.

Evaluation of Quality in Market Transactions

In actual trading practices, notable differences occurred in methods used for determining quality of the two principal types of linters--felting and chemical. These differences resulted from the nature of the two types and in manufacturing requirements. To converters who purchase linters for felting purposes such quality items as length of fibers, harshness, color, and foreign matter are of primary consideration. These quality items, in the opinion of many, can be determined only by actual inspection. On the other hand manufacturers of linters pulp are concerned with cellulose content and freedom from foreign matter, particularly shale.

Inspection of bales was the basis of quality used in final settlement on 78 percent of the felting-type linters during the 1951-52 season (table 10). The term "inspection of bales," frequently used in the linters trade, refers to personal inspection of bales or samples without immediate reference to a standard guide for evaluating quality. Inspection often consisted of appraisal of samples from some rather than all of the bales in a particular lot. A verbal description of qualities involved was usually made at the time of the sales agreement, final acceptance being based on inspection by the buyer at the time of delivery. In some marketing transactions in which quality evaluation is based on inspection, the buyer may reject delivery, if in his opinion the linters are not of the quality agreed upon at time of sale. On the other hand, when demand for linters is great, some buyers accept linters of lower quality than originally agreed upon. Unfavorable price changes frequently are contributing factors. More equitable trading might be brought about by basing sales agreements on firm contracts which provide for evaluation of quality according to an impartial standard.

Table 10.--Proportions of felting-type and chemical-type linters marketed according to specified methods of quality evaluation, United States, season 1951-52

Method of quality evaluation	Felting-type linters	Chemical-type linters
	Percent	Percent
Official standards	12	1
Private types	8	1
Inspection of bales	78	4
Description of type	2	-
Cellulose content 1/	--	94
Total	100	100

1/ Usually includes inspection of bales.

The official linters standards served as the basis of quality evaluation in the final settlement of 12 percent of the felting-type linters. The standards were frequently referred to in describing qualities, in preliminary sales agreements, and in discussing qualities during settlement, although final acceptance may have been on the basis of inspection. Classifications made according to the standards by the Board of Cotton Linters Examiners, licensed classers, and others were beneficial as quality guides in marketing.

Private linters types served as the basis of quality evaluation on 8 percent of the felting-type linters. About 2 percent of the felting linters were marketed according to a verbal or written description of the type or quality involved. Descriptions may have included identification of items such as type of cut, mill producing the linters, area of production, description of particular quality items, comparison with qualities of previous lots sold, and classification according to the standards.

Domestic manufacturers of cellulose pulp from linters adhered strictly to cellulose content of the linters as the basis of quality on which purchases were made. Usually transactions between sellers and chemical converters consisted of preliminary acceptance on the basis of inspection for amount and kind of foreign matter, or on the basis of description, the final settlement being on cellulose content.

Chemical-type linters are also utilized in production of battery boxes, padding, and other products. To manufacturers of these products, items other than cellulose content, such as length of fibers and foreign matter, are of primary consideration in appraising quality of the linters to be used. Approximately 4 percent of the chemical-type linters were marketed on the basis of inspection of bales in 1951-52. The official linters standards and private linters types each served as the basis of quality evaluation for 1 percent of the chemical-type linters.

Transportation and Weighing

As compared with many agricultural products, linters are bulky in relation to their weight and value. Because of this bulkiness, movement of linters over long distances often is impractical. Oil mills that produce linters are located throughout the Cotton Belt, whereas an even wider geographic distribution occurs among converters who utilize linters. Linters must be transported considerable distance from producing areas in order to reach converters in the Northeastern and North central states. In such instances, transportation becomes particularly important as a cost of marketing. Linters are usually shipped by rail or truck.

Linters are customarily sold in accordance with rules of the National Cottonseed Products Association or the American Cotton Linters Association which provide that sales be made on weights as determined by the seller, the weights being guaranteed to within one-half of 1 percent at destination. Oil mills determine weights at the time the linters are produced. A second weighing is usually made by oil mills at time of shipment, especially if the linters have been in storage and there is a possibility of change in weight. The purchaser may reweigh the linters upon receipt and claim any difference between shipping and receiving weights of more than the accepted tolerance. However, according to members of the linters trade, claims for differences in weights are seldom made unless the weight difference considerably exceeds the accepted tolerance.

Storage

In general, oil mills do not store linters for extended periods of time. This was indicated by the rather close association between average monthly production, shipments, and stocks of linters at oil mills during the 5 seasons, 1947-48 through 1951-52 (fig. 4). Also, the pattern of production and movement of linters from oil mills reflects the seasonal nature of the processing of cottonseed. The volume of linters shipped was slightly less than the volume produced during the fall months, but shipments exceeded production from February through July. The stocks of linters stored or on hand at oil mills increased during the harvesting season, reaching a peak in January, approximately 2 to 3 months after the peak occurred in production. Stocks at mills decreased after January, but exceeded the volumes produced and shipped during that period.

Some oil mills endeavored to arrange the sale of their linters production in a manner which would permit the loading of bales directly onto rail cars or trucks at the time of production thereby reducing costs of handling and storage. However, forward sales of linters did not always prove feasible, and facilities were needed for storing linters between time of production and shipment. Almost 90 percent of the oil mills utilized storage houses for storing linters during the 1951-52 season (table 11). Open sheds were used by 20 percent of the oil mills. Some mills utilized both storage houses and sheds. Linters stored in the open were usually placed on the ground, and in some instances, on a platform with no cover. Open storage was used by only 4 percent of the oil mills in the United States. This practice was quite common in the far western region where the possibility of weather damage was relatively low on account of the dry climate.

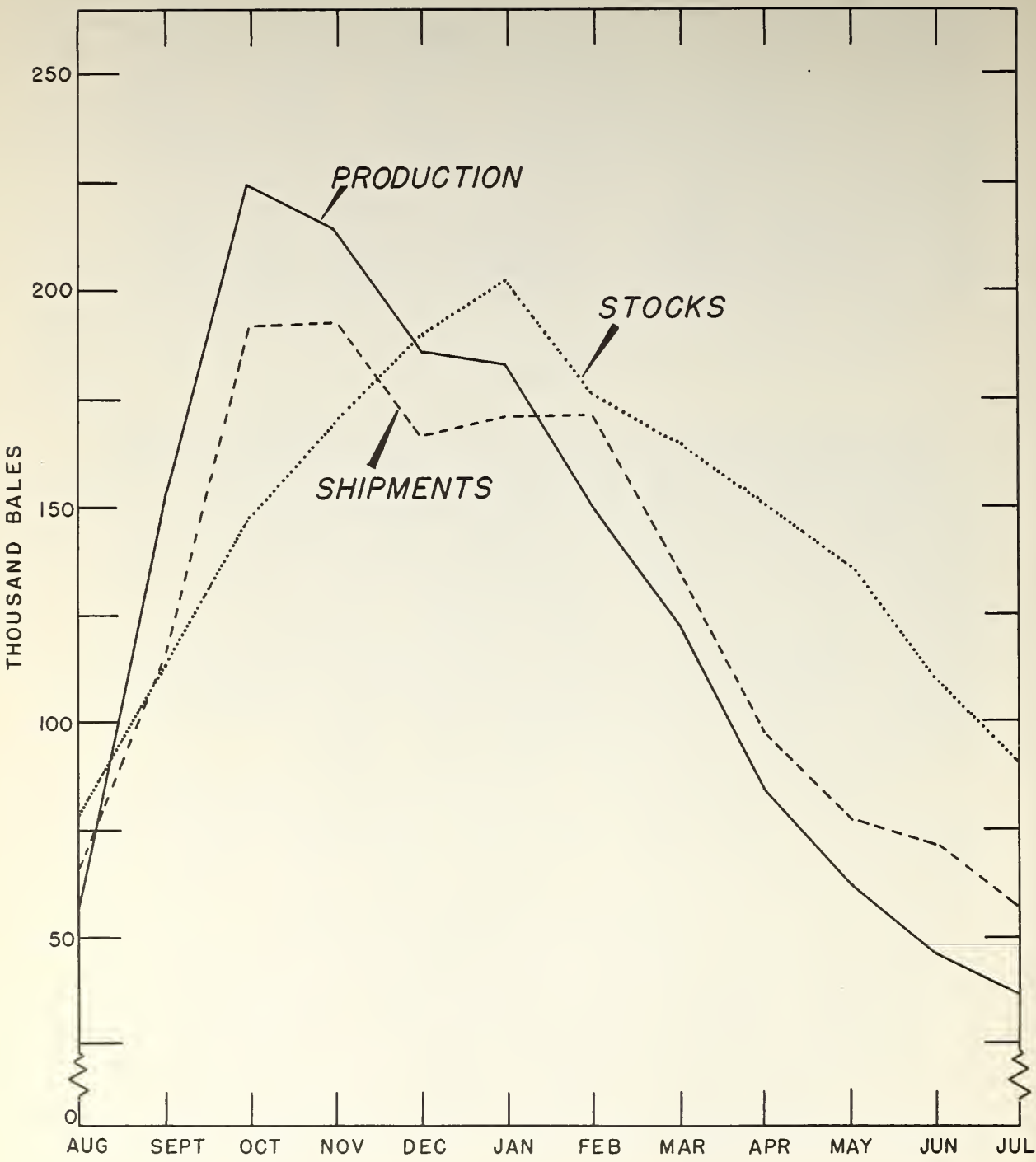

Figure 4.--Linters production, shipments, and end of month stocks at oil mills in the United States, by months, five season average, 1947-48 through 1951-52.

Table 11.--Type and capacity of facilities used for storing linters at oil mills and proportion of total linters production for which mill storage space was available, United States, season 1951-52

Type of facility	Oil mills having storage facilities 1/	Av. storage capacity per mill	Proportion of total linters production for which oil mill storage was available
	Percent	Bales	Percent
Storage houses	88	797	19
Storage sheds	20	115	3
Open storage	4	2/	2/

1/ Some mills utilized more than one type of storage facility.
2/ Capacity for storage of linters in open was generally unlimited.

The capacity of storage houses averaged almost 800 bales of linters per mill, and the average storage shed space at an oil mill could accommodate 115 bales of linters. The capacity for storage of linters on the mill yard or other open area near the mill was usually unlimited. In many instances storage facilities at oil mills are somewhat flexible in that they may be used for storage of cottonseed, linters, meal, or other products as the occasion necessitates.

In 1951-52 oil mills had covered storage facilities for linters the full use of which at any one time would have held 22 percent of the total volume of linters produced during that season. Storage houses at oil mills could have accommodated 19 percent of the season's total production; 3 percent could have been stored in sheds.

In order to minimize costs of handling and storing linters, as well as possible losses from adverse price changes, dealers often arranged their purchases and sales so that no storage was required. Linters dealers indicated that 60 percent of the linters which they handled in 1951-52 were not stored between time of purchase and sale (table 12). Dealers made arrangements with oil mills to hold 32 percent of the linters they purchased until notification concerning shipment. Linters purchased by dealers under such arrangements were usually stored at the oil mill for a relatively short period of time and in the storage facilities customarily used by the oil mill. Dealers stored about 6 percent of their purchases in public warehouses, whereas about 1 percent was held in private warehouses and 1 percent on railroad platforms.

Table 12.--Proportions of linters stored by dealers between purchase and sale, and facilities used for storage, United States, season 1951-52

Type of storage facility	Proportion of linters handled by dealers
	Percent
Linters not stored	60
Linters stored at:	
Oil mills	32
Public warehouses	6
Private warehouses	1
Railroad platforms	1
Total	100

Converters usually carry a reserve supply of linters in order to avoid delays in their operations from lack of raw materials. An adequate reserve supply was considered very important by bleachers or chemical converters of linters, as indicated by the large volume of linters on hand at bleaching plants throughout most of the season (fig. 5). During the five seasons 1947-48 through 1951-52, average monthly stocks of linters at bleaching plants increased from about 82,000 bales at the end of September to 220,000 bales at the end of February and March, then declined to 120,000 bales at the end of the season in July. The volume of linters stored at bleaching plants was substantially in excess of volumes consumed, consumption averaging between 60,000 and 70,000 bales during most months of the season.

Felters and other converters of linters increased their stocks of linters from about 78,000 bales at the end of September to 100,000 bales in February and March. The volume of linters consumed by felters and other converters averaged approximately 45,000 to 50,000 bales per month, and neither stocks or consumption varied greatly from month to month.

Information obtained in this study indicated that linters in public storage and at compresses were composed mostly of supplies being stored by converters and by the Government in connection with price-support programs. Linters on hand at public storage establishments increased from an average of about 62,000 bales at the end of September and October to 110,000 bales at the end of April and remained at about this level until the end of the season.

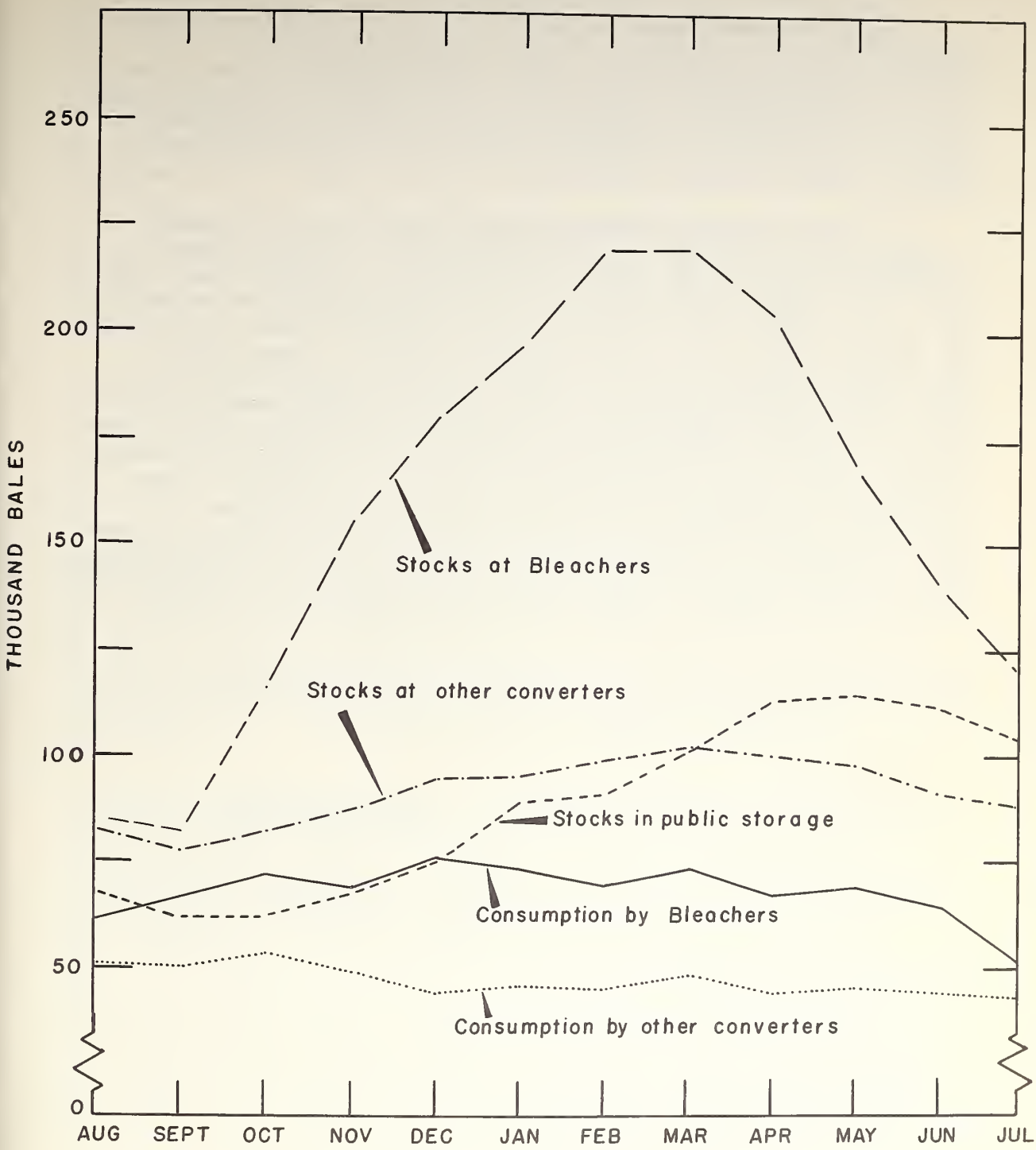

Figure 5.--Consumption and stocks of linters at bleachers and other converters, and stocks in public storage in the United States, monthly average for five seasons 1947-48 through 1951-52.

Market Information

Market news information was usually obtained by members of the linters trade for the purpose of judging market conditions as a basis of trading or in determining the most advantageous time to buy or sell. Of particular interest was current prices at which different qualities of linters were being marketed. News of general market activity and of linters production, stocks, consumption, and price-support programs was also popular with various segments of the trade.

One of the principal sources of market information on linters to members of the linters trade was information obtained through contact with others in the trade. In addition to verbal information, some type of market news report on linters was usually obtained by the various segments of the trade during the 1951-52 season (table 13). The Weekly Cotton Linters Review issued by the U. S. Department of Agriculture was received by 80 percent of the oil mill operators, 87 percent of dealers and brokers, and 42 percent of the converters. The report gives a summary of market and price information on linters, tables of current price ranges for each grade of uncompressed linters f.o.b. oil mills, and tables relating to production, supply, demand for domestic consumption and export, and other pertinent news on linters. Committees appointed by the American Cotton Linters Association supply market information for the report in each of the principal markets. Price quotations and other market news are also obtained from individual brokers, dealers, oil mill operators, and others.

Table 13.--Sources of market news reports on linters received by oil mill operators, linters dealers and brokers, and converters in the United States, season 1951-52

Source of market news reports	Proportion of --		
	Oil mill operators	Dealers and brokers	Converters
	Percent	Percent	Percent
Market reports or newsletters from:			
U. S. Dept. of Agriculture	80	87	42
Dealers	25	2	2
Trade associations	1	16	4
Commercial news services	3	4	2
Trade newspapers	--	5	3

Several dealers gathered market information and relayed this information, in the form of newsletters, to oil mills from which they purchased linters. Dealer's newsletters were received by 25 percent of the oil mill operators, and by 2 percent of the converters, and 2 percent of the dealers and brokers. Newsletters of commercial news services were subscribed to by less than 5 percent of the linters trade. Such reports normally contained information on linters as well as other cottonseed products and competing products.

Trade newspapers, such as the Cotton Trade Journal and the Daily News Record, were cited by 5 percent or less of the dealers, brokers, and converters as a source from which they obtained market information on linters. No trade members reported receipt of market news by means of radio.

Linters dealers and brokers tended to keep themselves better informed on the marketing situation than did other segments of the trade. Approximately three-fifths of the brokers and dealers, as compared with one-third of the oil mill operators and one-fourth of the converters, received some type of market information daily during the active marketing season (table 14). Market news reports or verbal information on the linters market was received no more frequently than once a week or "every few days" by slightly more than one-half of the mill operators, and one-fourth of the dealers, brokers, and converters. Almost one-half of the converters did not follow the linters market situation closely during the active marketing season except when they were interested in purchasing linters. Likewise, approximately 10 percent of the oil mill operators, dealers, and brokers obtained information only when they were ready to buy or sell linters.

From these data it appears that there is need for the various segments of the linters trade to familiarize themselves with sources of market news at their disposal, the best sources suited to their individual needs, and the advantages which can be obtained from market news. Reliable and current market information on items such as prices, qualities, and supplies of linters can be of value to buyer and seller. Lack of familiarity with sources of market news can result in incomplete or inaccurate information. This difficulty can be lessened if information is obtained from several different sources and from market news collected and authenticated by some disinterested agency. Care should be exercised in the interpretation and application of market information, much of which is, by necessity, of a general nature and cannot always be applied in detail.

Table 14.--Frequency of receipt of linters market information by oil mill operators, dealers and brokers, and converters, United States, season 1951-52

Frequency with which market information received	Oil mill operators	Dealers and brokers	Converters
	Percent	Percent	Percent
Daily	34	61	26
Weekly	57	27	26
When marketing	9	12	48
Total	100	100	100

MARKET OUTLETS FOR COTTON LINTERS

Principal Uses

Cotton linters are utilized in the manufacture of a relatively large number of consumer and industrial products. On a volume basis, the most important use of linters is in the chemical industry for the manufacture of rayon, acetate, plastics, explosives, paper, and a number of other products. The chemical uses collectively represented about 61 percent of the total consumption of linters for the season 1951-52 (fig. 6). The principal nonchemical uses are for bedding, automobile batts and pads, and furniture upholstery. Relatively small amounts of linters are consumed in the manufacture of other products such as battery boxes, medical supplies, and linoleum. Spinning of linters to produce twine, carpet yarns, and mop heads was a common use of linters in earlier years, but cotton waste and other products have displaced linters in this field.

In practically every field of use, linters encounter competition from other materials. For some uses, linters are preferred owing to superior characteristics or qualities, but in most instances some substitution of other materials is possible. Prices frequently encourage the use of competing materials. A basic disadvantage of linters in competition with other materials has traditionally been that of relative instability of price and supply.

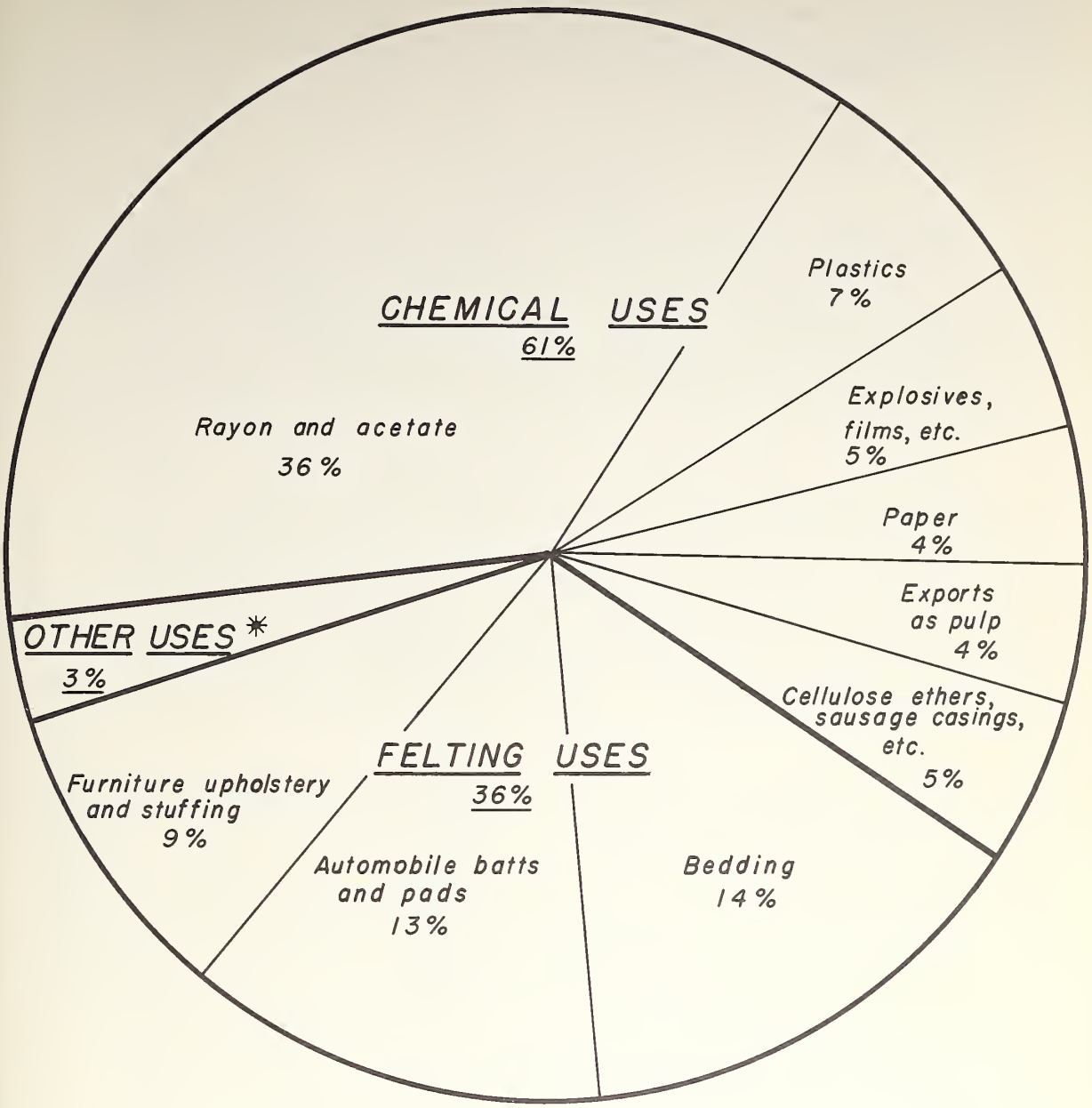

Figure 6.--Principal uses of cotton linters in the United States, season of 1951-52.

* Includes battery boxes, medical supplies, linoleum, and various other uses.

In the course of this study no attempt was made to explore the nature and extent of each of the specific market outlets for linters, some of which are relatively less important from the standpoint of volume. Analyses were made of the principal fields of use for linters--present and potential.

Chemical Uses

Cotton linters contain from 65 to 85 percent of high-quality cellulose. Linters are preferred in producing cellulose pulp because of ease of processing, strength, clarity, high alpha cellulose content, and high viscosity--all considered desirable characteristics. The "second-cut" or shorter staple linters (U. S. Grades 5, 6, and 7) are most suitable for producing cellulose pulp and are referred to as the chemical grades, although "bleachers" use some Grade 4 linters.

"Bleachers," a term applied to firms engaged in the processing of linters into linters pulp, processed approximately 60 percent of all linters consumed during the 5-year period 1948-52 (table 15). The proportions used by such processors ranged from 56 to 61 percent of the linters consumed during those years. An average of 813,000 bales of linters was used annually by the linters pulp processors during that 5-year period. Although small quantities of chemical grade linters are converted into pulp for special purposes, practically all of the commercially available pulp is produced by three firms in the United States.

Table 15.--Consumption of linters by bleachers and other consumers, United States, 1948-52

Year	Bleachers		Other consumers		Total
	1,000 bales	Percent	1,000 bales	Percent	1,000 bales
1948	709	57	531	43	1,240
1949	924	60	610	40	1,534
1950	917	59	644	41	1,561
1951	822	61	523	39	1,345
1952	692	56	547	44	1,239
5-year average	813	59	571	41	1,384

Source: Bureau of the Census.

Synthetic Fibers

Chemical grade linters, processed into linters pulp, compete directly with dissolving and special alpha grade wood pulp for use in acetate and high-tenacity viscose rayon and other synthetics. Before the late 1930's only a part of the cellulose for the cupra-ammonium process and high-tenacity viscose rayon and acetate could be made from wood cellulose. During that period it was necessary that approximately 40 percent linters pulp be combined with wood pulp in the production of high-tenacity rayon. However, improved technology in the wood-dissolving field has made it possible to use wood pulp exclusively in the production of viscose rayon and acetate. The production of dissolving wood pulp in the United States has increased from less than 200,000 tons in 1935 to more than 700,000 tons in 1952 (table 16). Linters pulp, therefore, must now compete directly with the high-tenacity and acetate grades of wood pulp in this field of use.

Table 16.--Domestic production of dissolving wood pulp in the United States, 1935-52

Year	Production	Year	Production
	Tons		Tons
1935	189,536	1944	447,487
1936	307,594	1945	382,618
1937	353,640	1946	316,573
1938	228,261	1947	407,387
1939	193,420	1948	419,683
1940	326,729	1949	374,050
1941	260,690	1950	478,849
1942	403,723	1951	616,802
1943	390,423	1952	706,000

Source: U. S. Pulp Producers Association, Inc.

During the 5 years 1948 through 1952, dissolving wood pulp represented 71 percent or more of the total supply of linters pulp and wood pulp combined (table 17). In 1948, production of linters pulp amounted to about 156,800 tons or 20 percent of total pulp supply. The volume and proportion of linters pulp supply increased in 1949, but declined thereafter until in 1952 the tonnage available was approximately the same as in 1948, but represented only 15 percent of the total cellulose supply.

Table 17.--Supply of linters pulp and dissolving wood pulp in the United States, 1948-52

Year	Linters pulp 1/		Dissolving wood pulp 2/		Total
	Tons	Percent	Tons	Percent	Tons
1948	156,800	20	637,182	80	793,982
1949	204,400	29	502,503	71	706,903
1950	202,800	23	688,569	77	891,369
1951	181,800	18	816,556	82	998,356
1952	153,100	15	864,655	85	1,017,755

1/ Calculated from Census data based on 73 percent available cellulose, 606 pounds net weight bales.

2/ Production plus imports minus exports.

Source: U. S. Pulp Producers Association, Inc.

The notable increase in production of rayon since 1930 has been reflected in the volume of cellulose pulp consumed by that industry. Total pulp requirements amounted to 549,500 tons in 1952 compared with 72,000 tons in 1930 (table 18). Approximately 40 percent of the cellulose requirements of the rayon and acetate industries were met by the use of linters pulp during the 6-year period 1930-35. Subsequent to that time, the rapidly increasing demands of the rayon industry for cellulose pulp were met, for the most part, by using larger proportions of wood pulp. Nonetheless, the use of linters continued to increase to some extent until 1950 when 134,000 tons were used but this quantity represented only 23 percent of the pulp consumed by the industry. In 1951 and 1952, linters pulp amounted to only 16 and 12 percent, respectively, of total pulp used in rayon. In terms of raw linters,

Table 18.--Production of rayon and acetate and consumption of wood pulp and linters pulp by the rayon and acetate industries, United States, 1930-52

Year	Production of rayon and acetate	Pulp consumption					Linters pulp in terms of raw linters 1/
		Total pulp	Wood pulp		Linters pulp		
	Tons	Tons	Tons	Percent	Tons	Percent	1,000 bales
1930	63,850	72,000	45,000	62	27,000	38	122
1931	75,850	84,000	53,000	63	31,000	37	140
1932	67,900	74,000	43,000	58	31,000	42	140
1933	107,800	115,000	65,000	57	50,000	43	226
1934	105,250	112,000	63,000	56	49,000	44	222
1935	131,050	137,000	86,000	63	51,000	37	231
1936	144,950	151,000	104,000	69	47,000	31	212
1937	170,400	176,000	132,000	75	44,000	25	199
1938	143,750	147,500	110,000	75	37,500	25	170
1939	189,950	194,500	145,000	75	49,500	25	224
1940	235,600	238,000	178,000	75	60,000	25	271
1941	286,600	287,500	214,500	75	73,000	25	330
1942	316,300	320,000	280,500	88	39,500	12	179
1943	331,550	336,500	281,000	84	55,500	16	251
1944	361,950	367,000	285,000	78	82,000	22	371
1945	396,050	400,000	297,000	74	103,000	26	466
1946	426,950	428,000	323,000	75	105,000	25	475
1947	487,550	478,000	397,000	83	81,000	17	366
1948	562,150	539,500	435,000	81	104,500	19	472
1949	497,850	476,600	348,700	73	127,900	27	578
1950	629,700	590,600	456,200	77	134,400	23	608
1951	647,100	616,300	515,500	84	100,800	16	456
1952	567,900	549,500	484,700	88	64,800	12	293

1/ Estimated bales of raw cotton linters required to produce the linters pulp figures shown in preceding column. Calculated on the basis of 73 percent available cellulose in raw linters and converted to bales on the basis of 606 pounds net weight per bale.

Source: TEXTILE ORGANON, February and March 1953.

consumption varied from time to time, but showed a general upward trend from 122,000 bales in 1930 to 608,000 bales in 1950.

The rapidly increasing production of synthetic fibers and other products requiring cellulose caused manufacturers to seek increasing supplies of cellulose material. As linters pulp production was not adequate to meet the demand, manufacturers turned to dissolving wood pulp to augment their supply. The capacity of the dissolving wood pulp industry continues to increase. The probable capacity, based on actual construction and firm commitments, is estimated to reach 1,240,421 tons by January 1, 1955 (table 19). This represents an increase of about 340 percent since 1946.

Table 19.--Dissolving wood pulp capacity in the United States, by years, 1946-52, and estimated capacity as of January 1, 1953-55

Year	Capacity
	Tons
1946	364,000
1947	420,500
1948	425,758
1949	432,250
1950	479,204
1951	616,888
1952	739,366
1953	857,096
1954	1,141,421
1955	1,240,421

Source: U. S. Pulp Producers Association, Inc., Wood Pulp Statistics, August 1952.

Comparative Prices of Raw Linters, Linters Pulp, and Wood Pulp

Prices of raw linters and linters pulp follow essentially the same pattern as the price of linters pulp is based on the cost of linters plus costs of transportation and processing. During the 20-year period 1933-52, Grade 6 linters varied in price from 1.45 cents per pound in 1939 to 11.97 cents per pound in 1951 (table 20). During this period linters pulp was priced at 5.65 cents per pound in 1939 and 23.96 cents per pound in 1951. Such extreme fluctuation in the price of raw materials is a distinct disadvantage when a competing material is available at more stable prices. Prices for wood pulp remained stable for long periods with a gradual trend upward. Prices for dissolving wood pulp were lower than linters pulp from 1933 through 1952, the only exception being in 1949. In that year the price of chemical linters was extremely low, allowing linters pulp to fall below the price of acetate wood pulp.

Linters pulp is 99.5 percent pure alpha cellulose and is sold on the basis of maximum moisture content of 7 percent. Dissolving wood pulp (bone dry), on the other hand, contains approximately 95 percent alpha cellulose in the acetate grade and 91 percent alpha cellulose in the high-tenacity grade. Furthermore, wood pulp is sold "air dried" with a maximum moisture content of 10 percent. The actual percentage of pure dry alpha cellulose in linters pulp is 92.5 percent as compared with 85 percent for acetate grade wood pulp and 81 percent for high-tenacity grade wood pulp. Because of these facts, the available dry alpha cellulose content should be considered in making price comparisions for the various types of pulp.

Although linters pulp is preferred because of the purity of cellulose, the actual cost per pound of pure dry linter cellulose was higher than wood pulp cellulose in all years except 1949 (table 21). In 1952, the actual cost per pound of pure dry cellulose averaged 15.57 cents in the form of linters pulp, 13.23 cents in acetate grade wood pulp, and 12.04 cents in high-tenacity wood pulp. In order for linters pulp to have competed effectively with these grades of wood pulp, it appears that a reduction in the price of linters pulp of from 2.5 cents to 3.5 cents per pound from the average level of prices for 1952 would have been necessary.

Table 20.--Comparative price per pound of Grade 6 linters, linters pulp, and dissolving wood pulp of designated grades, United States, 1933-52

Year	Grade 6 linters	Linters pulp	Dissolving wood pulp	
			Acetate and cupra grade	High-tenacity viscose grade
	Cents	Cents	Cents	Cents
1933	-	5.00	-	-
1934	2.15	6.40	-	-
1935	3.63	8.75	-	-
1936	3.72	8.10	5.00	-
1937	3.61	8.75	5.00	-
1938	2.72	5.75	5.00	-
1939	1.45	5.65	5.00	-
1940	3.16	6.65	5.00	-
1941	3.28	7.60	5.00	-
1942	3.50	8.15	5.00	-
1943	3.41	9.15	5.71	4.25
1944	2.97	8.80	5.50	4.81
1945	3.44	8.70	5.50	5.00
1946	5.10	9.50	6.15	5.85
1947	7.75	16.30	8.04	7.44
1948	4.64	11.26	9.20	8.44
1949	2.40	8.62	9.06	8.44
1950	8.29	16.86	9.18	8.43
1951	11.97	23.96	11.25	9.75
1952	5.96	14.40	11.25	9.75

Table 21.--Comparative costs of pure dry alpha cellulose in linters pulp, acetate grade wood pulp, and high-tenacity viscose grade wood pulp, United States, 1933-52

Year	Cost per pound for pure dry cellulose in-- 1/		
		Wood pulp	
	Linters pulp	Acetate grade	High-tenacity viscose grade
	Cents	Cents	Cents
1933	5.41	-	-
1934	6.92	-	-
1935	9.46	-	-
1936	8.76	5.88	-
1937	9.46	5.88	-
1938	6.22	5.88	-
1939	6.11	5.88	-
1940	7.19	5.88	-
1941	8.22	5.88	-
1942	8.81	5.88	-
1943	9.89	6.71	5.25
1944	9.51	6.47	5.94
1945	9.40	6.47	6.18
1946	10.27	7.23	7.22
1947	17.62	9.46	9.19
1948	12.17	10.82	10.42
1949	9.32	10.65	10.42
1950	18.23	10.80	10.41
1951	25.90	13.23	12.04
1952	15.57	13.23	12.04

1/ Computed on the basis of average market prices and the following conversion factors for impurities and moisture content: Linters pulp, 1.081; acetate grade wood pulp, 1.176; high-tenacity viscose wood pulp, 1.235.

In order to determine the price at which chemical linters are competitive for certain markets, it is necessary to relate linters pulp prices directly to prices for raw linters. In 1952, the price of Grade 6 linters averaged 5.96 cents per pound. On the basis of 1-cent per pound transportation cost to pulp plants (an estimate made in the linters pulp industry), the delivered price was 6.96 cents. Assuming a basic 73 percent cellulose content, the equivalent cost of linters required to produce 1 pound of pulp averaged 9.53 cents in 1952. The difference between this cost and 14.40 cents--the average market price of linters pulp--resulted in a processing spread of 4.87 cents per pound. With a processing spread of 4.87 cents per pound and after adjustments for actual cellulose content, the cost of 1 pound of pure dry cellulose was 15.57 cents.

On the basis of an average price of 4.40 cents per pound for raw chemical grade linters in 1952, and by using the procedure indicated above, it was determined that 1 pound of pure dry cellulose from linters pulp would cost 13.26 cents. This compares favorably with a cost of 13.23 cents for pure dry cellulose in acetate grade wood pulp at market prices prevailing in 1952. In order to have competed pricewise with the high-tenacity grade of wood pulp, a reduction would have been necessary in the price of raw linters or in costs of marketing or processing linters into pulp.

In general, it appears that the price of chemical grade raw linters is an important factor affecting their use as a source of cellulose pulp. If market outlets for linters are to be maintained, the price of linters will necessarily have to be at a sufficiently low level to enable linters to compete effectively with wood pulp. Achieving such an objective will be difficult since, as indicated by available data, linters are at a disadvantage with respect to variable supply as well as price compared with wood pulp. With increasing capacities for processing wood pulp and improvements in processing technology resulting in improved qualities and reduced costs, it is likely that the price of wood pulp will be sufficiently low to encourage its use.

In considering the area of competition and the potential consumption of linters in the field of synthetic fibers, it should be remembered that linters do not compete with all grades of wood pulp in the manufacture of rayon. With respect to price as well as quality, linters compete most effectively with the acetate and high-tenacity grades rather than with the standard viscose grade of wood pulp. Producers of high-tenacity rayon yarn, and acetate yarn, staple, and tow required from 276,830 tons of pulp in 1948 to 342,090 tons in 1952 (table 22). This was equivalent to 1,251,500 bales of linters in 1948 and 1,546,600 bales in 1952. In the latter year, pulp used for the manufacture of high-tenacity rayon yarn was equivalent to about 1 million bales of linters and that used for the manufacture of acetate was equivalent to about one-half million bales. It is apparent, therefore, that a sizable potential market for linters in these uses would be available if prices of the grades required for them were competitive with wood pulp.

Table 22.--Production of high-tenacity rayon yarn and acetate yarn, staple, and tow, estimated pulp required and equivalent in cotton linters, United States, 1948-52

Year	High-tenacity rayon yarn production 1/	Acetate yarn, staple, and tow production 1/	Estimated total pulp requirement 2/	Equivalent in raw linters 3/
	Tons	Tons	Tons	Bales
1948	131,550	188,750	276,830	1,251,500
1949	144,650	160,800	271,675	1,228,200
1950	154,100	221,800	324,770	1,468,300
1951	166,400	214,400	333,120	1,506,000
1952	206,150	164,750	342,090	1,546,600

1/ TEXTILE ORGANON, February 1953.

2/ Estimate based on 0.7 lb. linters pulp required to produce 1 lb. acetate and 1.1 lb. linters pulp to produce 1 lb. high-tenacity rayon.

3/ Estimate based on net weight bales of 606 lbs. having cellulose content of 73 percent.

Paper

The potential use of linters in that segment of the paper industry engaged in the manufacture of fine writing paper or "rag content" type of paper has considerable promise. Paper of this type is usually made of various proportions of wood pulp and cotton rag pulp or linters pulp. The higher grades of paper contain larger proportions of rag pulp or linters pulp in relation to the wood pulp content. Some of the highest grades of paper for legal documents, bonds, and very high-grade stationery are made from 100 percent rags or linters.

Manufacturers of paper of this type have traditionally used rags as a source of cotton fiber. For a number of years, however, the industry has been using some raw cotton fiber in the form of staple cotton, linters, and cotton mill waste (table 23). The use of cotton fiber in this field received considerable impetus from cotton diversion programs of the U. S. Department of Agriculture a few years ago. Since 1949 the use of linters has increased and in 1952 approximately 57,800 bales were consumed in fine writing paper.

Table 23.--Consumption of raw cotton fiber in terms of linters used in the manufacture of fine writing paper, 1945-52

Year	Type of raw cotton fiber	Equivalent quantity of linters
		Bales 1/
1945	Cotton lint	141,400
1946	Cotton lint	174,000
1947	Cotton lint	91,800
1948	Cotton lint and mill waste	39,400
1949	Mill waste, linters, and linters pulp	41,700
1950	Linters and linters pulp	44,700
1951	Linters and linters pulp	44,300
1952	Linters and linters pulp	57,800

1/ Bales of 606 lbs. net weight.
Source: Writing Paper Manufacturers' Association.

The use of raw cotton fiber in the form of linters or staple cotton has been impeded to some extent by technological problems of preparing the fiber for use in making paper. However, the principal obstacle to the more extensive use of the raw cotton fibers in this field has been the price factor. Until recently prices for cotton linters, linters pulp, and staple cotton were at levels much above the level for rags.

Writing paper manufacturers have indicated increased interest in the use of cotton linters. This interest has been stimulated by recent favorable price levels for linters, and by technological problems encountered in the use of rags. Rags and garment cuttings containing synthetic fibers apparently cannot be utilized satisfactorily in the manufacture of fine paper. Furthermore, some of the newer dyes used in finishing cotton fabrics present problems for the paper manufacturers from the standpoint of bleaching. For these reasons there is considerable promise in the use of linters as a substitute for rags.

One of the principal problems in utilizing linters in the manufacture of writing paper is the limited capacity of existing equipment at paper plants for processing the linters into pulp. It is estimated that present facilities used for preparing rags could accommodate only about 60 percent as much linters as rags, as linters are more bulky and require more time for processing. Heretofore, when linters were used in substitution for rags, it was necessary to purchase some linters pulp from bleaching plants in order to maintain the cotton fiber content desired in the paper.

Apparently paper manufacturers have found it more economical to process their own linters pulp to the extent of their capacity. No doubt this is because linters pulp for the manufacture of paper does not have to be purified to the extent necessary for pulp used in synthetic fibers, explosives, and some other uses for which linters pulp customarily is prepared by bleachers. This is indicated by the fact that writing paper manufacturers report a processing loss of about 20 percent when converting linters into pulp as compared with an average loss of about 27 percent for bleachers. Data available for 1951-52 indicate that the paper manufacturers made some saving in purchasing raw linters and processing their own pulp (table 24).

Table 24.--Comparative costs per pound 1/ to manufacturers of rag content writing paper for linters pulp prepared from raw linters, linters pulp available commercially, and rags, by months, January 1951 - December 1952

Year and month	Linters pulp prepared from raw linters	Linters pulp available commercially	Rags
	Cents	Cents	Cents
1951			
January	26.75	27.85	20.43
February	27.51	27.80	21.17
March	27.56	27.80	21.42
April	30.04	27.80	21.06
May	25.98	27.76	18.71
June	22.12	27.74	18.22
July	19.62	23.50	17.90
August	17.88	22.54	17.83
September	18.88	19.30	18.00
October	18.01	19.07	17.96
November	17.02	16.47	18.19
December	17.14	17.12	17.95
1952			
January	17.00	18.83	17.41
February	17.89	18.56	17.31
March	16.31	18.37	17.03
April	15.30	16.81	16.55
May	17.55	16.38	15.27
June	15.88	15.40	14.06
July	16.29	16.57	14.33
August	14.84	15.79	14.28
September	14.25	12.37	14.28
October	15.35	11.87	13.87
November	12.05	11.59	13.81
December	11.28	11.33	13.29

1/ Calculated from data compiled by the Writing Paper Manufacturers' Association. Includes delivered cost of material, cost of processing material for use in paper, if any, and processing loss, if any.

A number of experiments relative to the use of linters and other cotton fibers have been sponsored by the paper industry. A research project designed to develop more efficient technology for processing linters to be used in writing paper was begun in February 1953 at the Institute of Paper Chemistry located at Appleton, Wis. This research is being sponsored by the Writing Paper Manufacturers Association and may aid materially in solving technological problems in the use of linters for the manufacture of writing paper.

An analysis of available data with respect to the extent of use of cotton fiber in the manufacture of writing paper indicates a maximum potential market outlet in this field of utilization equivalent to approximately 300,000 bales per year (table 25).

On the basis of recent level of prices for those grades of linters suitable for this purpose, as well as present and prospective technological factors, it appears that a substantial part of this market will be open to linters. Raw linters at 5 cents per pound, having a transportation cost of 1 cent, a processing loss of 20 percent, and a pulp processing cost of 4 cents per pound, provide linters pulp at 11.5 cents per pound in comparison with a cost in February 1953 of about 12.45 cents per pound for rags processed ready for use in the paper mixture. Offsetting technological advantages and disadvantages of the two sources of cotton fiber would appear to be in favor of linters. Obviously rag prices could be expected to decline to some extent if smaller quantities were used for paper manufacture.

Felting Uses

Approximately 40 percent of total linters production in 1952-53 was utilized in the manufacture of bedding, automobile batts and pads, and furniture upholstery. Included in the general felting category are linters utilized in production of commercial felt sold to manufacturers of bedding, automobiles, and furniture.

Table 25.--Production of rag content writing paper in the United States, 1938-52, and estimated production, 1953

Year	Production of writing paper of--				Linters equivalent to total cotton fiber content 1/
	100 percent rag content	50 to 100 percent rag content	Less than 50 percent rag content	Total	
	Tons	Tons	Tons	Tons	Bales
1938	10,000	28,468	31,000	69,468	146,613
1939	13,420	28,017	42,460	83,897	171,376
1940	12,143	33,816	47,455	93,414	186,210
1941	19,025	45,871	51,824	116,720	250,183
1942	27,395	69,658	69,993	167,046	364,772
1943	23,115	75,723	60,579	159,417	353,045
1944	25,815	96,006	46,907	168,728	402,375
1945	27,685	99,563	44,709	171,957	416,993
1946	28,258	82,491	64,765	175,514	396,025
1947	26,639	71,559	75,912	174,110	372,658
1948	22,297	51,144	56,922	130,361	282,530
1949	19,026	45,021	55,772	119,819	252,067
1950	21,566	50,569	66,569	138,236	286,776
1951	26,333	55,970	78,586	160,889	333,964
1952	22,634	46,201	64,306	133,141	278,793
1953 2/	24,000	54,000	72,000	150,000	312,000

1/ Calculated on the basis of average cotton fiber content of each type paper, a 20 percent loss in processing, and 606-pound net weight bales.

2/ Estimated.

Source: Writing Paper Manufacturers' Association.

Quantities and Qualities of Linters Used for Felting Purposes

Total consumption of linters for felting purposes was approximately one-half million bales per year in recent years (table 26). At this rate, consumption was about equal to production of the felting grades of linters. The amount of linters used in bedding products increased from 139,000 bales in the 1947-48 season to 204,000 bales in 1950-51. Trade information indicated that consumption of linters in bedding dropped to about 177,000 bales in the 1951-52 season. Consumption of linters by automobile and furniture manufacturers followed similar trends.

Table 26.--Estimated consumption of linters in bedding, automobiles, and furniture, United States, seasons 1947-48 through 1951-52 1/

Season	Consumption of linters in--			
	Bedding	Automobiles	Furniture	Total
	1,000 bales	1,000 bales	1,000 bales	1,000 bales
1947-48	139	171	140	450
1948-49	135	180	190	505
1949-50	199	186	201	586
1950-51	204	193	134	531
1951-52	177	167	117	461

1/ Estimated from information obtained from trade sources and reports of National Cotton Council.

The higher qualities of linters are preferred in the manufacture of felt for bedding, automobiles, and furniture. During the 1951-52 season more than 96 percent of the linters used in bedding materials were Grades 2, 3 or 4 (table 27). Less than 4 percent of the linters used for bedding were classed as Grade 5 or below. Manufacturers of stuffing and padding for furniture used slightly larger proportions of lower grade linters, but, by far, preferred Grades 2, 3 and 4. Felts and pads going into automobiles were composed almost entirely of Grades 2 and 3 linters.

Table 27.--Qualities of linters used by converters in the manufacture of specified materials, United States, season 1951-52

Qualities used	Linters used in--		
	Bedding	Automobiles	Furniture
	Percent	Percent	Percent
U. S. standard grades:			
2 and 3 1/	65	99	69
2, 3 and 4	23	--	17
3 only	8	--	5
4 and 5	3	1	7
4, 5 and 6 2/	1	--	2
Total	100	100	100

1/ Includes less than 1 percent Grade 1.
2/ Includes less than 0.5 percent Grade 7.

Comparison of Linters with Competitive Felting Materials

A variety of materials is used for felting purposes including foam rubber, hair, shoddy, cotton linters, staple cotton, oil mill motes, and cotton manufacturing waste materials such as picker, fly, card strips, comber noils, clippings, pickings, and sweeps. Linters comprised from 50 to 60 percent of the fibrous materials used in bedding, automobiles, and furniture, in 1951-52 (table 28).

Approximately nine-tenths of the linters used went into felting mixes containing from 40 to 80 percent linters in 1951-52, according to manufacturers of the three types of felting materials.

Table 28.--Proportions of linters in fibrous materials used for the manufacture of specified products, United States, season 1951-52

Linters content (percent)	Proportionate use of specified linters contents by manufacturers of--		
	Bedding	Automotive batts and pads	Furniture upholstery
	Percent	Percent	Percent
10 - 19	1/	-	-
20 - 29	1	-	1
30 - 39	1	2	2
40 - 49	15	-	1
50 - 59	16	70	18
60 - 69	46	28	43
70 - 79	19	-	24
80 - 89	1/	-	11
90 - 99	1	-	-
100	1	-	-
Total	100	100	100
Average	57	52	60

1/ Less than 0.5 percent.

The most common type of felting material is composed of a mixture of linters and cotton waste. Converters reported that in 1951-52 a number of different "mixes" of linters waste were usually made, the proportion of each depending upon the characteristics desired in the specific end-product. For example, if resiliency were important, a large proportion of linters were used. Mill waste serves as the binder, and linters provide the buoyancy and filling

properties desired in bedding as well as in automobile and furniture felting. Since they serve different purposes and customarily are not completely substituted for each other, linters and mill waste are not fully competitive, although the ratio of linters and mill waste may vary considerably. When linters are prohibitive in price or unavailable for use, some felters substitute second-hand cotton, cuttings, and cotton or wool shoddy. The use of second-hand materials (usually much lower in price than linters) as a substitute for linters is more common in the manufacture of inferior quality products sold at relatively low prices.

In determining the proportion of linters to use, about three-fourths of the felting manufacturers gave primary consideration to the relative prices of linters and competing fibers in the 1951-52 season (table 29). If linters were relatively high in price, competing materials were usually substituted to the extent technically feasible. However, a preference for linters was expressed by many and linters were generally used if the price was not prohibitive. Almost one-fifth of the bedding manufacturers and one-fourth of the automobile batt and furniture upholstery processors stated that they did not vary the proportion of linters used because linters were needed in order to maintain a standard of quality in products manufactured.

The popularity of foam rubber mattresses has increased, production increasing from 34,000 foam rubber mattresses in 1947 to about 356,000 in 1951, according to the Bureau of Census. However, this production is relatively small compared with production of more than 11,000,000 inner-spring and soft-filled mattresses in 1950. At present foam rubber mattresses compete only with the higher priced inner-spring mattresses. It appears that foam rubber does not at present constitute a serious competitor to linters for use in the large majority of bedding products.

Foam rubber also has become popular for use in automobiles and furniture. However, these industries have found that the use of foam rubber with inner-springs gives best results in many instances. This construction limits the amount of foam rubber that can be used since felting is necessary to act as a cap over the springs and under the rubber. Also, felt is often used over the edges and siding of the foam rubber to get the best effects of design and wear.

Table 29.--Primary considerations of converters in determining the proportion of linters to use in manufacturing specified products, United States, season 1951-52

Primary consideration	Proportion of linters used in--		
	Bedding	Automobile batts and pads	Furniture upholstery
	Percent	Percent	Percent
Relative prices and availability of linters and competing fibers	82	76	77
No variation in proportion of linters used because of specific quality of products produced	18	24	23
Total	100	100	100

In 1952, prices of felting grade linters averaged less than cotton waste materials commonly used by the felting industry (table 30). From 1940 through 1951 the higher qualities of felting linters usually averaged slightly higher in price than did picker waste and card fly. Since 1951, however, the prices of linters have declined in relation to cotton waste prices, and linters appear to be improving with regard to the competitive price situation.

Indications are that consumption of linters by the felting industry will be maintained at about the present rate so long as supplies do not vary substantially and linters prices remain about equal to or lower than cotton picker waste. It appears that variable supply and price are not likely to cause permanent and excessive loss of market outlets for felting grade linters, whereas chemical grade linters face serious competition and possible loss of markets to wood pulp for these reasons. Nevertheless, the possibility of increase in use of such products as foam rubber, sisal, shredded wood pulp, and rubberized hair cannot be totally discounted as a threat to markets now held by felting grades of linters.

Table 30.--Comparative prices of specified felting grades of linters and cotton manufacturing waste materials used in the felting industry, United States, 1940-52

Year	Linters		Cotton manufacturing waste		
	U. S. Grade 2	U. S. Grade 4	Picker waste	Card fly	Upland card strips
	Cents/lb.	Cents/lb.	Cents/lb.	Cents/lb.	Cents/lb.
1940	4.87	3.87	4.15	3.30	7.07
1941	7.16	5.37	4.69	4.22	8.33
1942	10.02	7.34	4.87	4.07	10.05
1943	8.70	6.23	4.95	4.22	9.24
1944	7.06	4.78	4.97	4.38	10.61
1945	7.25	5.11	5.27	4.37	10.95
1946	11.71	6.56	6.80	5.42	12.25
1947	11.01	8.57	9.15	6.84	14.61
1948	9.04	6.54	9.82	7.07	17.75
1949	8.60	4.92	11.00	9.00	19.00
1950	14.73	10.95	13.58	12.50	25.60
1951	19.51	14.58	17.17	15.75	29.50
1952	12.30	7.89	19.42	16.25	30.09

Source: Linters prices from Weekly Cotton Linters Review and cotton waste prices from the National Cotton Council of America.

Battery Boxes and Absorbent Cotton

Information obtained from converters indicated that the volume of linters used in the manufacture of battery boxes amounted to more than 20,000 bales in the 1951-52 season. The higher quality of second-cut linters are preferred for this use, since they are relatively economical in price and are adequate to serve as a binder and give desired tensile strength. Approximately nine-tenths of the linters used in battery boxes in 1951-52 were Grades 5 and 6, the remaining one-tenth being composed of Grades 3 and 4. Linters of relatively high oil or trash content are not suited for this use.

In the manufacture of battery boxes, linters are blended with asphalt and other materials then rolled or molded into desired form. Therefore, linters require relatively little processing, and are preferred for use in battery boxes over kraft paper and similar competing materials, provided the price of linters does not become prohibitive.

The medical supply industry uses about 2,000 bales of linters annually in the manufacture of low quality absorbent cotton for industrial filtration, stuffing, packing insulation, and similar purposes. In general, linters are considered to be too low in quality to meet standards for surgical dressing and similar medical supplies. Linters are usually bleached, sterilized, then mixed in the ratio of two-thirds linters to one-third comber waste to make low grade absorbent cotton. Relatively long staple linters are preferred and Grade 2 linters comprised more than 90 percent of the linters used by converters in 1951-52 for this purpose.

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